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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/652,785	08/29/2003	Gopinath Kuduvalli	7291.P045	3405

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EXAMINER	
LAMPRECHT, JOEL	

ART UNIT	PAPER NUMBER
3737	

DATE MAILED: 10/18/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/652,785	KUDUVALLI ET AL.	
	Examiner	Art Unit	
	Joel M. Lamprecht	3737	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 August 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-30* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17 and 22-30* is/are rejected.

7)☒ Claim(s) *18-21* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 8/29/03 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 1/12/06; 9/12/05; 4/16/04
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

1. Claims 1-7, 9-11. 22-28 rejected under 35 U.S.C. 102(e) as being anticipated by Thomson (US PUB 2004/0267113). Thomson discloses a radiosurgical method and system comprising, generating pre-treatment 3d scan(s) showing the position of a target [0009], generating a set of 2d reconstructed images from that 3d scan [0040], generating at or near real time one or more 2d x-ray images of the target [0011 and 0029], registering the reconstructed images with the x-ray images by computing transformation parameters to represent the change in position [0040], and adjusting the position of the radiosurgical beam generator and the target by the amount prescribed by the 3d transformation parameters [0010, 0041].

2. Thomson also discloses the 3d t-form parameters representing the difference in position of the target at treatment versus the position at treatment planning time [0040].

3. Thomson also discloses repeatedly generating images throughout treatment, and keeping the radiosurgical beams properly focused onto the target area throughout the surgery [0010 0040].

4. Thomson also discloses generating a treatment plan after step a and before step b [0041] specifying the number, intensity and direction of the radiosurgical beams [also claim 16].

5. Thomson also discloses processing x-rays to match the orientation, image size, bit depth, etc of the x-ray images with the reconstructed 2d images [0036 for motivations], [0040, 0041, 0042].

6. Thomson also discloses Claim 7 as listed including the verbiage DRR [0040].

7. Thomson also discloses transmitting at least two x-ray imaging beams through the targets and onto image planes (received by an x-ray camera) to generate the x-ray projection images [0022].

8. Thomson discloses Claims 10 & 27 iteratively through [0040] as it would only take a repetition of Thomson's disclosure to perform the method of Claim 10/ the system of Claim 27.

9. Thomson also discloses registering the reconstruction images with x-ray images individually and *combining* the factors for reconstruction to obtain a set of 3d transformation parameters [0038 - 0040].

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Claims 8, 12-16, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thomson in view of Penney et al. (Enclosed and cited below). Thomson discloses Claim 1 as listed above but fails to explicitly state that the system/method is using rigid body parameters or the six-degree of freedom method, as is the standard in 2d-3d reconstructions. Attention is then directed to the reference by Penney et al. (IEEE Transactions on Medical Imaging, Vol. 17, No. 4, Aug 1998), which teaches in the same field of endeavor the production of DRRs for a rigid body system using 6-degrees of freedom. Therefore it would have been obvious to one having normal skill in the art at the time of the invention to have utilized the six-degree of freedom method of Penny et al. in the process of Thomson to ensure the most accurate parameters are used for the reconstruction.

12. Thomson also discloses the methods of claims 9, 10, and 11 but fails to disclose explicitly which parameters are to be used with the disclosed transformation. Attention is then directed to the reference by Penney et al. which very clearly again discloses 10 similarity measures, and the in-depth comparison of six of those parameters. These comparisons comprise of at least, but not limited to, two out-of-plane rotations and three in-plane transformation

parameters. Therefore it would have been obvious to one having normal skill in the art at the time of the invention to have utilized rigid body parameters as is well-known in both the image processing art and stated in the Penney et al. reference, in the process described in Thomson to facilitate computational analysis and image processing.

13. Thomson also discloses generating DRRs at versions rotation angles in [0038 to 0041] but does not disclose specifying a set of rotation angles for each parameter. Attention is directed to the reference by Penney et al. which, in sections C, D and in the earlier section on parameters, disclose a specification method for parameters in all six degrees of freedom. From this disclosure, iterative intuition would suggest that one could generate two sets of DRRs if one wished to acquire multiple projections A and B respectively. Therefore it would have been obvious to one having normal skill in the art at the time of the invention to have utilized logical coordinate axes and the teachings of Penney et al. along with multiple iterations of the process disclosed by Thomson in order to produce two sets of DRRs comprising of different combinations of out-of-plane rotation angles.

14. Thomson also discloses a method for generating DRRs as mentioned including taking DRRs from/in different angles, intensities and quantities, but fails to explicitly (though it is hinted at) disclose computing a set of in-plane rotated DRRs by rotating the DRRs to create a set of reference DRRs. Attention is then directed to the secondary reference by Penney et al. which discloses in sections two and three how DRRs are produced, and related to the various parameters

listed above. Of these parameters in-plane rotations are without a doubt a feasible and intuitive especially as in-plane rotations are compared in the analysis section of the paper. Therefore it would have been obvious to one having normal skill in the art at the time of the invention to have utilized a set of rotated DRRs as disclosed in the Penney et al. reference in conjunction with the Thomson reference in order to produce the best intensity images possible.

15. Thomson also discloses all the limitations of Claim 16 including averaging multiple transformation parameters to ensure accuracy, except for the fact that the transformation parameters are never explicitly stated. Attention is then directed to the secondary reference by Penney et al. which discloses the 6-degree of freedom rigid body parameter set mentioned in Claim 16. Therefore it would have been obvious to one having normal skill in the art at the time of the invention to have utilized the six-degree of freedom rigid body parameter model disclosed by Penney et al. in conjunction with the reference by Thomson as is standard with *2d-3d rigid body* reconstructions where parameters for transformation are required.

16. Thomson discloses all the limitations of Claims 23, 28 and 29; except he does not explicitly disclose utilizing two out-of-plane rotational parameters and three in plane transformation parameters in [claims 29, 22, 0040]. Attention is directed on the Penny et al. reference, which describes 10 parameters comprising those disclosed in claim 29, and obviously adding additional information including a perspective projection in their analysis. Therefore it would have been obvious to one having normal skill in the art at the time of the

invention to have utilized a system defining transformation parameters by two out-of-plane rotational parameters and three in-plane rotational parameters as is disclosed by Penney et al. within the process disclosed by Thomson.

17. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thomson in further view of Penney et al. and in further view of Official Notice.

18. Thomson and Penney et al. disclose the limitations of Claim 16, but do not explicitly disclose a m+etric that is solved to obtain the result in Claim 17. The equations disclosed in Claim 17 as a relationship for 3D transformation parameters for projections A and B could be derived, as they are inherent direct relationships that are mathematically known. Thus, the Examiner takes Official Notice that it would have been obvious to one having reasonable skill in the art at the time of the invention to have made a decision to relate parameters in such a way as disclosed in Kuduvalli et al. to facilitate any further computations and implementations of the parametric data.

19. Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thomson in view of Penney et al. and in further view of Simon et al. (6,470,207).

20. Thomson and Penney et al. disclose all the limitations of Claim 15, except neither implies that the reference DRR is created offline. Attention is then directed to the secondary reference by Simon et al. which teaches preoperative (Col 16 line 40 – Col 17 line 10) acquisition of a DRR image to guide a surgical process. Therefore it would have been obvious to one having normal skill in the

art at the time of the invention to have utilized a preoperative or offline reference DRR in conjunction with the procedure suggested by Kuduvalli et al. to guide the surgery.

Claim Objections

21. Claims 18-21 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The prior art does not disclose the iterations disclosed in Claim 18 by estimating in-plane and then out-of-plane parameters, and while this is limiting to the scope of the patent disclosed, it makes the dependent claims 19-21 also allowable based on their dependence from Claim 18.

Conclusion

For further disclosure in regard to the multiple projection images that reads on this application see Murphy (US Patent 5901199), which also discloses translational parameters explicitly. Schweikard et al. (US Patent Application Publication 2004/0092815) discloses much information that seems pertinent to the current prosecution, including the generation of out of plane rotation angles, which could be applied with the DRR data enclosed herein. Frank et al. (US 20040215071 A1) describes a method for iteratively estimating and refining the in-plane and out-of-plane transformation parameters [0048 – 0049] [0070 – 0075] but does not provide enough detail to intuitively reject the current application.

Hsinchu et al. (US 20040208376 A1) describes a multi-level matching estimation in the same field of endeavor [0023 – 0025], but doesn't supply basis for the rejection of Claim 19 because of the lack of a rejection for Claim 18. Also listed here (in Form 892) for reference are the copending applications with similar content and subject matter.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joel M. Lamprecht whose telephone number is (571) 272-3250. The examiner can normally be reached on Monday-Friday 7:30AM-4PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian L. Casler can be reached on (571)272-4956. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JML
9/12/06

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